

The Ideal Mathematics Class for Grades 5 and 6:

What Do the Students Think?



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describes the ideal mathematics classroom from the students' points of view.

"I would like to have some fun with maths." (Ryan¹, Grade 5)

As teachers and researchers, we work hard to discover the most effective ways of teaching mathematics in the primary classroom. When searching for new tasks to teach or ways to adapt a task to fit the class's profile, we often "phone a friend," drawing on the know-how and knowledge of colleagues and experts. Other articles in this issue attempt to provide that kind of lifeline by looking at ways teachers can create or adapt tasks so that they engage and challenge most students. Here I want to consider another important source of expertise, one that is easy to overlook, simply because it is literally staring us in the face. We can also "ask the audience" — our students.

Asking the audience

As part of the Task Types in Mathematics Learning (TTML) research project, researchers from Monash University and the Australian Catholic University are conducting a survey of students in the middle years to find out about their experiences of learning mathematics. The students at Hakea primary school in Melbourne's less affluent northern suburbs helped us to refine our questions

1. Names of all the children and their school have been changed.

by completing trial versions of the survey, which has since been completed by around 1000 students in Grades 5 to 8 in Victorian schools. There were 18 students present on the day we visited: 12 Grade 5 students (five girls and seven boys) and six in Grade 6 (four girls and two boys).

The Hakea students' responses motivated us to add to the survey an open-ended question that asked students how they would advise pre-service teachers to engage their students in mathematics. This idea arose when we asked the Hakea students to rate a number of approaches to teaching mathematics. Not only did the question yield some firm convictions but, when we quizzed the students on their answers, their responses were so thoughtful and well-articulated that they would not have been out of place in a textbook on teaching mathematics. In order to capture more of the students' ideas about effective ways of teaching mathematics, we asked them to complete the following task:

Write a story about your ideal maths class.

Write about

- the sorts of questions or problems you like to answer,
- what you like to be doing, and
- what you like the teacher to be doing.

Any kind of maths, as long as it's a game

The classroom scenarios the Hakea students created in their stories were dynamic: children worked together, played games and moved around. Almost all of them wanted to leave the classroom or "do maths not in the same classroom always" (Hayley, Grade 6). As Campbell (Grade 6) put it, "I would like to do some maths games outside. I'm not really fussed what we do." This may sound like escapism, but in fact every one of the 18 students made a serious effort to imagine and communicate a scenario in which he or she enjoyed mathematics, rather than avoided it.

It was not altogether surprising to our research team that these children yearned for the outdoors, because on earlier survey trials many of them had described their favourite mathematics lesson as one where they had gone outside to measure parts of the school yard. Although that class had been in an earlier year, their recall and enthusiasm were vivid. A number of them remembered—and could even spell—the trundle wheel they had used. Preliminary results of the TTML Learning Mathematics Survey indicate that the Hakea children were not alone: primary students at other schools also named an outdoors lesson in measurement as the favourite of all the mathematics classes they had ever experienced. Figure 1 shows a story written by a Grade 5 girl, in which she describes the kinds of mathematics classes she enjoys.

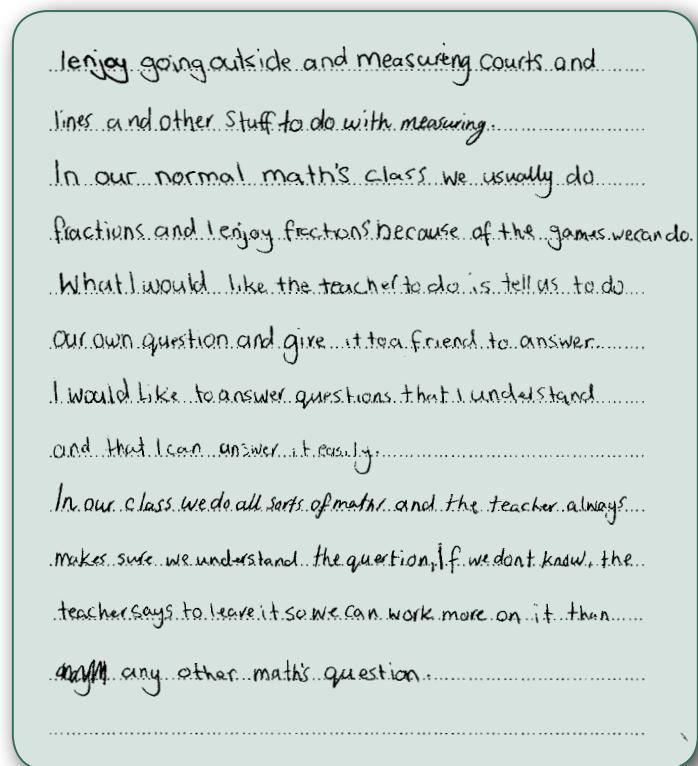


Figure 1. Story about an ideal mathematics classroom.

Becky enjoys games, variety and measurement tasks outside the classroom. She likes to create her own mathematics problems and to work with a friend, but her ideal mathematics teacher will "make sure we understand."

Learning through social interaction

The classroom format was equally important to the Hakea students, with all but two of the children commenting on this. Many envisaged working in groups (7)² or in pairs (5), sharing their completed work with the rest of the class (1) or helping a junior class with their mathematics (1). Several of the girls named friends with whom they would like to sit and three described how they would be allowed to talk with their friends during the lesson. Others perceived learning opportunities in working collaboratively. As Grade 6 student Andrew explained, he liked to work with a partner “because if you don’t understand the task then your partner may know and then you could learn off them.” Alex, in Grade 5, had the same idea from the opposite perspective. Confident where Andrew was anxious, he wanted to “show our work to the class every activity we do in Maths to give them some ideas if they don’t know.” Patrick, also in Grade 5, wanted to help the Grade 2–3 class with their mathematics.

Although working collaboratively was important to them, at the same time, seven of those same children wanted to use computers, worksheets or to work from problems the teacher had written on the board; activities that would have reduced their capacity for social interaction as an integral part of mathematical thinking. On the other hand, several students mentioned that they would be using the computer to play games with a friend. Simon, for example, would google “cool maths games,” while Tayla would like to “sit down on a computer next to a friend on a maths game such as Math Maze.”

In imagining mathematics learning as a shared, cooperative activity, these students described their ideal mathematics class as a “community of practice” (Lave & Wenger, 1991; Rogoff, Turkanis & Bartlett, 2001).

Building things and making mathematics work

The children in this Grade 5–6 class were excited about the set of 3D magnetic shapes their teacher had recently acquired for them. Using materials and learning through manipulating them was a popular choice (15). Four of the students wrote more generally about wanting to use “real things” to build models, while others wanted to make things with Lego (2), grapple with measuring equipment (2) or work on the interactive whiteboard (2). Sara from Grade 6 articulated her preference for working with colour as well as with numbers.

On an earlier visit to Hakea Primary, TTML researchers had asked the children what kind of mathematics classes they hated. From their answers it was clear that the conventional type of lesson, in which students worked from instructions or problems written on the board, was by far the most disliked. This dislike of working from the board was reiterated in six of the stories, including two that included remarks on the discomfort of having to “look up and down” between the board and their workbook. Yet two other children wrote that they liked working from the board, while another five wanted to use worksheets.

Differences according to age and gender

There was little difference between the responses of the 12 Grade 5 students and those of the six Grade 6 students, apart from a stronger preference among the sixth-graders for working in pairs and for using work sheets. There were a few differences between the boys and the girls in the class, although one cannot draw firm conclusions on the basis of the small numbers involved. More girls (8) than boys (2) were interested in working with materials such as Lego or the 3D magnetic shapes to build models. Girls

2. Here and subsequently, the numbers of students referred to are provided in parentheses.

were more likely to want to work with others (8 girls, 4 boys). Boys, on the other hand, showed a stronger preference for working autonomously, not necessarily alone, but by choosing challenging tasks (3 boys, 1 girl) and making up their own mathematics games or problems (5 boys, 1 girl), indicating that they wanted not only to choose their own mathematics task, but also to take charge of defining mathematics problems for their fellow students and, in the case of Alex from Grade 5, taking this authority further by showing his completed work to the class, “to give them some ideas if they don’t know.”

Interpreting students’ ideal of “fun and games”

How is a teacher to interpret and make use of student stories on the ideal mathematics lesson? Understandably, and despite their often sensible advice on teaching methods, the children did not construct what we would recognise as a lesson plan. This highlights our role as teachers in shaping a lesson out of an activity and to nurturing learners in an engaging context. The students’ ideal mathematics class was, in most cases, a wish list combining all the aspects of past mathematics classes that they had enjoyed. Grade 5 student, Ryan, for example, wrote a list of eight statements beginning with “I would like...” His list included disparate elements — games, easy work, algebra, working on the floor, times tables, fractions, and Lego — and concluded with the somewhat plaintive disclosure that, “I would like to have some fun with maths.” These comments typify the students’ overwhelming preference for mathematics classes that include games (15) and that release them from the constraints of their small classroom’s rows of desks (16). Ryan also articulated an anxiety about succeeding in mathematics that manifested in different ways in some of the other stories. Although only one other student wanted “easy” mathematics, the majority indicated

a strong desire to be helped by the teacher. This was the case with students who wanted to work autonomously by choosing their own solution paths or inventing their own games, as well as with those who wanted their teacher to show them what to do. Fifteen students described the kind of teacher they wanted. Such a teacher would give clear instructions and make sure everyone understood (4); would be involved, rather than just watching: walking around (4) and giving individual help (8). Andrew (Grade 6) was able to explain exactly how he wanted his teacher to help him when mathematics became difficult:

I like it when the teacher walks around and if you are having trouble they always come to you and help you understand it more so then when you do it again then you will know how to do it. I would like our teacher to give us a Math sheet each and we do it and when we finish we show the teacher the ones that we don’t really understand and then when we have math group who could call us up one by one and teach us the things we don’t know (Andrew, Grade 6).

One student declared that he wanted the teacher “to be not too distractible so like tell all the information at the start so I can concentrate on my work” (Campbell, Grade 6).

The students’ stories also expressed some anxiety in relation to their approaching transition to secondary school. Although the desire to learn algebra had spread through a group of five boys sitting together, Campbell, in Grade 6, explained this preference most clearly, as “some maths you do in high school so I can get ahead and ready for high school.”

Learning through security and insecurity

Krainer (1993) depicts the dilemma educators face in planning mathematics instruction as a spectrum, at one end of which is a preference for teaching that builds security in mathematical understanding by

following well-established ideas and theories, while at the other end lies a pedagogy that embraces insecurity, relying on pupils' creativity to draw on their experiences and intuitions and so discover mathematical understanding for themselves. He proposes that "powerful tasks" incorporate elements of both extremes—both the "security" of "team spirit" (the networking of students and the explicit interconnections of tasks) and the "insecurity" of autonomy (individual generation of new understandings).

The Hakea children's responses, when grouped according to their desire to work alone or with others, and their preference either to define their own rules or defer to the authority of the teacher, might be represented in the diagram shown in Figure 2.

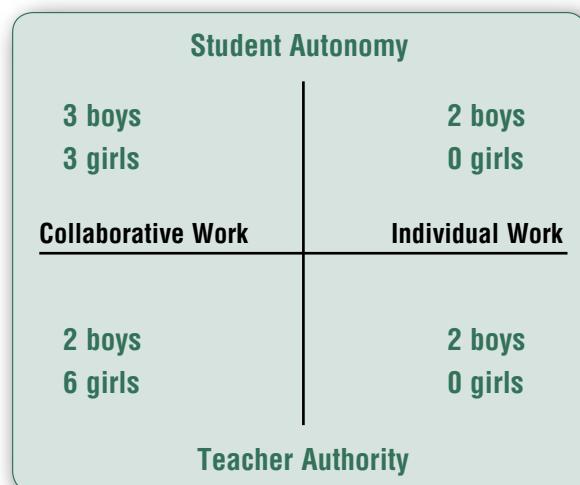


Figure 2. Diagrammatic representation of students' preferences in terms of autonomy and collaboration.

Those children whose stories conjured up a mathematics classroom in which they determine how, where and in what activities they will be engaged mostly wanted to work collaboratively (6 out of 8 children) and included more boys (5) than girls (3). Those who wanted the teacher to explain problems clearly and preferred mathematics with which they were familiar (e.g., "I would like to answer questions that I understand and that I can answer it easily,"), using worksheets or problems written on the board, also preferred working collaboratively (8 out of 10 children) and included more girls (6) than boys (4).

Implications for teaching

When planning for future classes, how is a teacher to respond to such competing preferences among students? In the following section I consider several examples of how these more general satisfactions and anxieties might inform a teacher's planning decisions.

An outdoor activity will obviously meet students' desire to escape the confines of the classroom and experience freedom to move around while the rest of the school stays inside. There are many activities in which a period outdoors can provide the material for further analysis and reflection, extending that exuberance and enthusiasm to following lessons. One successful outdoor activity is the task, shown in Figure 3, that Doug Clarke used in our project, in which students are encouraged to estimate and then measure the impact on soccer scoring of increasing the size of a soccer goal by the diameter of a soccer ball on three sides. In this successful outdoor task students estimate and then measure the impact on soccer scoring of increasing the size of a soccer goal.

The Type 1 tasks explored and constructed by Barbara Clarke (see Clarke & Sanders in this issue) bring moments of mathematical clarity — the learning epiphanies that will inspire

SOCKER'S NEW DIMENSION

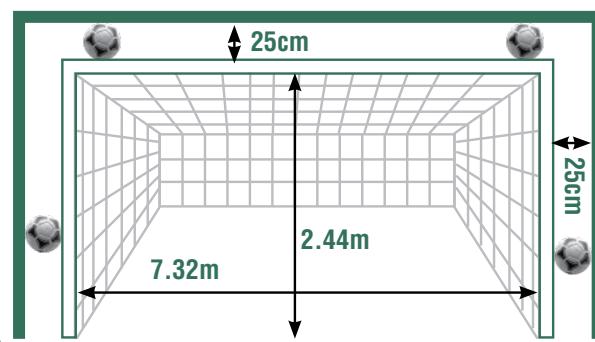


Figure 3. Soccer goal problem.

and expand the knowledge embedded in games. Here, the learning of a mathematical concept is reinforced by success in the game and by repetition in competition that

introduces rewards. Type 3 tasks (see Sullivan et al.) allow students to discover for themselves crucially important mathematical concepts. In these tasks, children are challenged and have the opportunity to choose their own directions and strategies, but are guided by the teacher's posing of the general problem.

In each of these cases, a teacher can encourage students to experience mathematics classes as fun, as social interaction and a liberation from the routine, a challenge and an assertion of individual creative intellectual work. At the same time, the teacher retains the authority to direct the students towards this open window, to point out to some what others can already see, to guide them as they interact with mathematical ideas that are just outside their comfort zone, to allow them to play with and tame these wild, new concepts so that they become a comfortable part of their everyday knowledge.

Writing the story of their ideal mathematics class may also benefit the students, in allowing them to reflect on past learning experiences and to use those experiences to create narratives of a mathematics class in which they feel secure and engaged through working alone or cooperatively, relying on their teacher to lead them through learning frontiers or venturing along their own learning paths. Through this process of reflecting on past learning, articulating their feelings about those

experiences and imagining future learning, primary students can begin (or continue) to practise metacognition—that “thinking about thinking” that will build their capacity to understand their own learning processes and difficulties (Schoenfeld, 1992). At the same time, their teacher can plan new adventures in mathematics learning with an enhanced understanding of their students’ needs.

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